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ORIGINAL ARTICLES

**PARTIAL RESECTION OF THE LOWER JAW FOR CANCER.<sup>1</sup>**

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IF an operation is only occasionally performed the exact field of its usefulness and the finer points in its technique are more or less forgotten. It is worth while to review such operations from time to time in order to examine their classical descriptions in the light of the present-day practice of surgery. Such an operation is the partial excision of the lower jaw.

This operation is rarely required for trauma, and in cases of osteomyelitis the removal of bone is almost invariably subperiosteal and not, therefore, a true resection of the jaw. It is in the presence of tumors, and especially malignant tumors, that resection of the lower jaw finds its chief use.

I have performed this operation upon fourteen patients in the last three years, and their histories form the basis of a profitable study.

The operation is almost exactly one hundred years old, having been performed for the removal of a new growth by Dupuytren in 1812. Mott, of New York, performed it in 1821, and in February, 1831, Barton published an article in the AMER. JOUR. MED. SCI., in which he says: "The records of medicine in this country, as well as in Europe, have already afforded so many examples of the suc-

<sup>1</sup> Read before the Clinical Society of the New York Polyclinic Hospital, April 5, 1915.

cessful removal of large portions of the lower jaw, in cases where the bone had been involved in disease, as to justify and establish the practice in desperate cases, and to require that the operation should henceforth be ranked among those in regular surgery."

He illustrated his article by steel engravings of a patient before and after operation, and pictured the saw employed to divide the bone, the instrument being of a type perfectly adapted to the purpose (Fig. 1).

The early operators had as subjects for their skill, patients entirely conscious or partly stupefied with drugs, for anesthetics did not come into practical use much before 1850. The patient was seated in a strong chair and held by main force, although the polite term employed in the description is, "his head was supported by an assistant." The operation was often interrupted by the "restlessness of the patient." The ordeal must have been a severe one for all concerned. It is true that the surgeon was never hampered by an inefficient anesthetist, but that he had other troubles may be seen from O'Shaughnessy's description of an operation performed about 1821.

"Professor Lallemand, of Montpellier, removed a considerable portion of the base of the lower jaw, and when the muscles of the

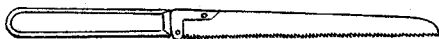


Fig. 1.—Drawing of saw used in 1831 for resection of the lower jaw. (Barton.)

tongue were cut through the patient fell senseless on the floor. The assistants and spectators rushed horror-stricken from the room. The wound was bleeding violently and the greatest consternation and dismay prevailed. The professor immediately applied the actual cautery at a white heat to the surface of the wound, which succeeded in arresting the hemorrhage. He then made an opening into the larynx between the thyroid and cricoid cartilages, through which the air rushed into the trachea, and the patient revived immediately, and ultimately perfectly recovered."

The operation as first performed was commenced by ligation of the common carotid artery, in order to control hemorrhage; but it was soon discovered that this was an unreliable procedure for the purpose and added much to the danger of the operation. It was therefore abandoned about 1820.

From such accounts of operations in the first third of the nineteenth century as I have been able to find, the incision employed ran downward from the mouth to the chin and outward along the base of the jaw. One or more teeth were extracted, sometimes a day or two previous to the operation; though one writer objected to this on the ground that the patient would be less sensible of the pain of their extraction if it were merged in the greater pains of the

operation. After the bone was bared in the places selected for its division it was sawed part way through with a small hand saw, or a chain saw; and then its denser portion was divided with cutting forceps.

The incision practised by Cusack, in 1827, is shown in Fig. 2. It would seem that such an extensive incision must surely have produced paralysis of the mouth and lower eyelid, although no mention of this is made in the description of the cases.

Cusack preferred the chain saw, as he found it difficult to protect the soft parts while using a small hand saw, and, moreover, he was often interrupted by the "restlessness of the patient."

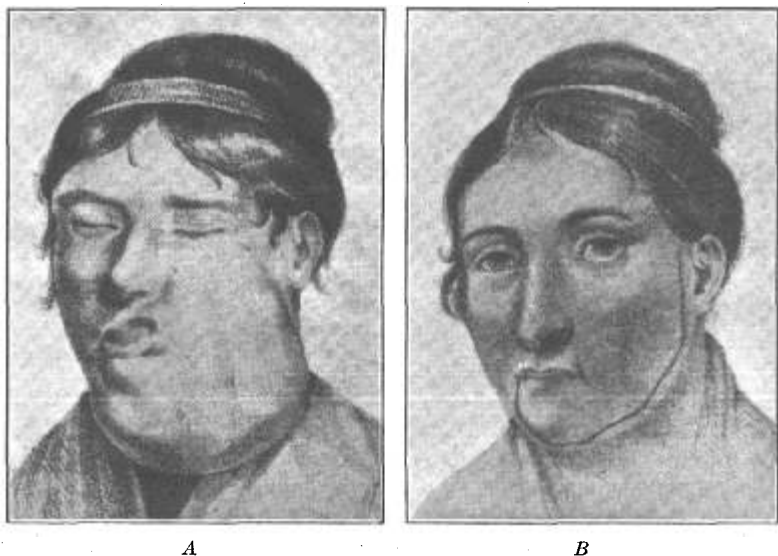


FIG. 2.—A, large tumor of lower jaw; B, patient after recovery, showing line of incision. (Cusack.)

In Liston's *Practical Surgery*, published in 1837, the incision recommended passed from the condyloid process downward to the angle of the jaw and then forward to the point of the chin. It was then mentioned that to cut through the lip adds to the facial disfigurement, and is in many cases quite unnecessary.

By the latter half of the nineteenth century the operation was so far perfected that the instruments and technique described by Gerich,<sup>2</sup> in 1864, vary little from those employed today. At that time, however, the sitting posture was still advocated to keep the blood out of the throat of the chloroformed patient.

Up to that time a number of incisions had been practised for

<sup>2</sup> Ueber Resection des Unterkiefers, Dorpat, 1864.

removal of different parts of the jaw, but the advantages of curved incisions following the lower and, if necessary, posterior margins of the bone were well recognized. Gerich was also keenly alive to the desirability of protecting Steno's duct and as many branches of the facial nerve as possible.

He pointed out correctly that if an incision along the posterior border of the ascending ramus extends above the level of the lobe of the ear the dissection must be conducted with great care or the branches to the eyelids will suffer; but through an incision no more extensive than this, disarticulation of the bone has often been carried out.

There are three ways, more or less distinct, in which partial resection of the lower jaw may be performed. These are: (1) resection from within the mouth; (2) external resection without disarticulation; (3) external resection with disarticulation.

While all operations for malignant tumors have to be modified to suit the particular case, and partial resection of the lower jaw is no exception to this rule, it is none the less convenient to consider it in these three forms, and to point out under what circumstances each should be employed.

1. Resection performed wholly within the mouth is not suitable for a tumor of the jaw of greater malignancy than an epulis, unless the tumor is a primary one in an early stage, and not involving the bone.

This was the operation performed in three of the cases reported in connection with this paper (Cases II, IX, and XIV). In two of these the tumor was an epulis, and the results of operation were satisfactory even though one tumor was recurrent. In the third the tumor was recurrent and of some degree of malignancy, but, owing partly to a doubtful pathological report, a decision was made to operate within the mouth in defiance of the rule above stated. The continuance of symptoms necessitated subsequent external resection, but the most favorable time for this had then passed.

The technique of resection within the mouth is very simple. An incision is made through healthy tissue completely around the tumor, everywhere down to the bone. With a small chisel and mallet a wedge-shaped piece of bone is chiseled free and removed with the tumor. The gross specimen is examined, and if the tumor is found to involve the bone, or if the cut surface of the bone appears diseased, a deeper layer of bone should be chiseled or gauged away. Nearly the whole thickness of the jaw can be removed without disfigurement or serious permanent injury. In a doubtful case an external resection is usually to be preferred.

Hemorrhage may be controlled with gauze packing. This should be removed daily, as it quickly becomes foul. As soon as granulations are well started no further dressing is needed.

2. External resection without disarticulation of the lower jaw is indicated in all cases of malignant tumors of the jaw itself or of the mucous membrane, or other soft parts close to it, in which there is a fair prospect that the incisions will lie outside of the diseased area. As stated above a resection from within the mouth is permissible for an early epithelioma involving the mucous membrane only.

External resection without disarticulation is more readily performed than resection with disarticulation. It is less dangerous than the latter, and it carries with it less risk of injury to the upper branches of the facial nerve. It is therefore to be chosen for both radical and palliative operations in which the tumor is so situated that the ascending ramus, and the adjacent soft parts are free from disease. Particular attention should be directed to the examination of the parts inside of the mouth, for the region of the pterygoid muscles is a favorite one for extension of a growth situated as far back as the molar teeth. If the disease is in the vicinity of the ascending ramus, disarticulation should be the invariable rule. This is true of even a palliative operation, as the patient will have less pain if the upper part of the jaw is removed.

External resection, in my judgment, is not a good palliative procedure if the disease is so situated that the whole chin would have to be removed; or if as much as one-half of the floor of the mouth is involved, because in such cases the patient is usually more uncomfortable after operation than he was before it. If there is a fair chance of complete removal of the tumor, even these extensive operations may be justifiable; but a most careful examination should be made before they are decided upon. The condition of the floor of the mouth is of the greatest importance in this decision.

The technique of external resection in a simple case is as follows: An incision is made from the point of the chin along the lower margin of the jaw to the angle, and then downward along the sternomastoid muscle to its middle. Skin, fat, and platysma are cut through, the flap dissected downward, the facial artery and vein ligated and divided. The fat, facia, and glands lying between the anterior belly of the digastric muscle and the sternomastoid muscle are dissected free from the hyoid bone upward, and necessary vessels are ligated and divided. The presence of enlarged lymph glands may make necessary a dissection back of the sternomastoid, or as far down as the clavicle. This part of the operation should always be thoroughly done.

If the skin of the cheek is plainly not involved it is dissected upward for an inch or more, care being taken not to injure the upper fibers of the facial nerve. Within the mouth an incision is made wide of the tumor both along the cheek and the floor of the mouth. The external and internal wounds are deepened until

they meet on both sides of the jaw, at least at the places at which the bone is to be divided. The cheek can then be retracted upward out of the way of the saw. Any tooth which is in line of an incision through the bone should be extracted, as should be any tooth which will remain close to the incision, for a tooth so situated will become loose and give the patient much annoyance.

One of the best saws for cutting the bone is a small hack saw (Fig. 3). If an instrument maker gets hold of it he is likely to nickel plate it, thereby changing it from a real tool into an ornament. As furnished by the manufacturer it is ready to cut metal, and it cuts the "hardest bone in the body" as an ordinary saw cuts wood.

If the cheek is retracted and a strip of metal like a tongue depressor or a flat blunt scissors is held back of the bone to protect the tongue, the surgeon can work the saw vigorously in short strokes that rapidly eat away the bone. When the bone has been divided the fragment to be removed is held with strong forceps while the

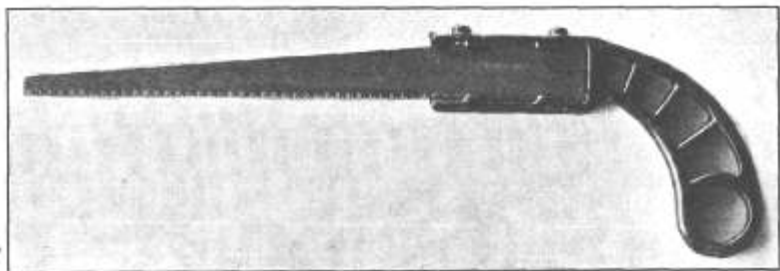


FIG. 3.—Hack saw for cutting jaw bone.

bone is sawed in the second place. If a splinter breaks off or the soft parts get in the way the section may be completed with bone shears. The loosened fragment is then turned down and its deep attachments are divided, permitting it to be removed with the mass of glands.

All bleeding is stopped by clamps or hot compresses, for as in all serious operations for malignant tumors the preservation of his blood is the salvation of the patient. Vessels which still bleed are ligated with fine catgut. The wound is carefully gone over. Suspicious spots, whether of bone or soft tissue, are still further excised. The cut ends of the bone are rounded a little with bone shears. Flaps are approximated and sutured both within the mouth and externally, except for about an inch where gauze or rubber tissue drainage is employed. It is desirable to suture the wound in the mouth completely. When this is done primary union often results throughout its greater portion and leakage is slight. If extensive removal of mucous membrane prevents complete

suture the internal wound should still be closed as nearly as possible and the remaining gap stopped with the gauze.

Primary union of so much of the external wound as is sutured is the rule, and all stitches should be removed in less than a week. The power of growth of these tissues is tremendous, and even a considerable hole into the mouth rapidly fills in.

Probably for this reason necrosis of the cut ends of the bone is not common. I experienced it only twice after nine external resections without disarticulation (eighteen cut surfaces of bone).

If the growth is so situated that the part of the jaw carrying the incisors must be removed the incision and dissection of the neck as above described should be carried out on both sides to provide for the removal of involved lymph glands.

The chief dangers of this operation are associated with (a) anesthesia, (b) excessive hemorrhage, (c) blood in the throat, and (d) falling backward of the tongue when its attachments are severed. These are all real dangers and deserve careful consideration.

(a) The ordinary mouth anesthesia is not well adapted to external resection of the jaw, and it adds materially to the risk of operation. Vapor anesthesia through the nose is much better if the patient can be kept under by this method, which is by no means certain. Rectal anesthesia<sup>3</sup> is ideal. If necessary the mask and a little ether or chloroform can be used to put the patient deeply under at the start. After that the anesthetist and his apparatus are entirely out of the way and, more important still, there is no increased mucous and saliva in the patient's throat.

(b) Excessive hemorrhage should be guarded against from the beginning of operation. Large vessels should be clamped before they are cut. Smaller ones should be promptly controlled by clamps or pressure. The worst region is below or back of the angle of the jaw, where a large vein may be cut laterally or some branch severed while the tissues are on the stretch. Then when they are relaxed the vein withdraws and a fountain of dark blood wells up from some unseen opening. Pressure on both sides of it to stop the flow, and division of the superficial tissues until the vessel is clearly exposed are the surest ways to meet the difficulty. It is well not to push the deep dissection in this region until the jaw has been cut through twice. The dissection can then be carried from above downward, which lessens the risk of serious venous hemorrhage, and the mobility of the bone makes deep exposure easier.

(c) Blood can be kept out of the throat by a good-sized pad of gauze kept in the mouth and changed as often as it becomes saturated. A string through it is a safeguard against swallowing, but

<sup>3</sup> Ether, 1 ounce by measure to 25 pounds of the body weight, is mixed with paraffin oil in the proportion of two parts of ether to one part of oil. This is injected slowly into the empty rectum one-half hour before operation. A preliminary hypodermic of  $\frac{1}{4}$  or  $\frac{1}{2}$  grain of morphin is advisable.

a quicker way is to clamp a corner of it projecting from the mouth.

(d) A heavy thread should always be passed through the tongue either in the middle line or a little to the affected side. It serves to draw the tongue out of the way, and can be used to prevent the loosened tongue from blocking the throat. This accident is more likely to happen the farther forward the excision. If the digastric and muscles anterior to it are divided, the tongue sometimes almost snaps back into the throat. If held forward for a few minutes the tendency grows less as the remaining muscles become accustomed to the change; but such a patient must be watched every minute until he is well out of his anesthetic. I nearly lost one patient from suffocation produced in this way. At the close of operation I left the house surgeon to apply the dressing and went into an adjoining room. In a few minutes I was called back and found the patient black, making no effort to breathe, and almost pulseless. When the bandage was cut off and the tongue pulled forward he still made no effort to breathe, but revived after a few minutes of artificial respiration. One may readily arrange a mechanical contrivance to hold the tongue forward, but it is safer not to leave a patient for a few hours, whose tongue tends to sag back into the throat. During this time the thread should of course remain in the tongue.

3. External resection of the lower jaw with disarticulation is indicated in cases of malignant tumors situated far back in the cheek, or in the jaw bone, and especially if such a tumor is recurrent, for in such a case the involvement of the ascending ramus or of the muscles lying on its inner side may be present to an extent not readily determined by examination of the patient. The technique of its performance is similar to that of external resection. It is therefore only necessary to mention certain differences.

The incision has generally to be extended up in front of the ear a variable distance. It is quite easy to remove a normal jaw without injury to the upper branches of the facial nerve, but a wide excision of soft parts is more important than the preservation of the parotid gland and facial nerve if the tumor involves the ascending ramus or tissues in its neighborhood. Therefore, one should not hesitate to sacrifice these important structures if it seems indicated to gain an increased freedom from recurrence. If the decision is to preserve the parotid gland or the greater part of it the skin incision should not extend above the external auditory meatus and the deeper incision not quite up to this. By dissecting under the parotid, especially in its anterior portion, it will then be possible to lift it and the cheek up and out of the way so as to permit of the disarticulation of the jaw. Before this is attempted the bone should be sawed through anteriorly and the dissection within the mouth completed. The muscles are then divided along



the malar bone from in front backward. When the temporal muscle is cut from the condyloid process the fragment of the jaw can be swung outward so as to expose the joint. The rather loose capsule is cut or torn and the bone with the tumor and the attached soft parts are removed. Removal of a part of the parotid gland usually leaves the patient with an external salivary fistula, but this soon dries up if the main duct is not interfered with.

**AFTER TREATMENT.** A patient upon whom there has been performed an external partial resection of the lower jaw, with or without disarticulation, should be carefully watched for a few hours to guard against recurrent hemorrhage or a blocking of the throat by the loosened tongue. Some of the patients have great difficulty in swallowing, especially if the dissection has been extended to the anterior pillar of the fauces. This is not to be wondered at when one thinks of the extent of the wound and its close relation to the muscles of tongue and throat.

No nourishment should be put into the patient's mouth until he has shown his ability to swallow water. In severe cases it may be necessary to employ nutrient enemata for a few days or, preferably, to pour fluids through a slender stomach tube passed through the nose and into the esophagus. It is not necessary for the tube to reach the stomach, so that a large rubber catheter may be used if no small stomach tube is at hand. This should be done only twice or three times a day, and a pint or more of water and fluid nourishment poured slowly through it each time.

Most patients swallow readily after two or three days. Only one patient in the present series (Case XI) had a prolonged difficulty in swallowing, and his tumor was so extensive that a part of his pharynx was cut out.

It is a good plan to allow these patients to sit up as soon as they may desire, sometimes after three or four days. They quickly learn to keep the mouth rinsed out, especially after taking nourishment, and if fluids from the mouth render the dressings foul, these should be changed twice daily. Postoperative pain is not as great as one might suppose from the extent of operation. The discomfort of the patient seems to be less than that which follows an excision of the tongue.

**RESULTS OF OPERATION.** Soon after operation the portion of the lower jaw which remains swings toward the operated side, thus bringing the molars within those of the upper jaw and the incisors back of the upper incisors. Various plans have been suggested to prevent this, two of which are worth mentioning: The upper and lower teeth may be wired together for a few weeks to keep the lower jaw in place while the wound is healing. A prothesis of wire or rubber, or some other non-irritating material, or a strip of live bone, may be inserted between the fragments of the bone after resection without disarticulation.

I have never employed these devices in malignant cases, as I believe their use is not advisable. Wiring the jaws is a dirty and irritating procedure, and the patient needs all the help he can have to keep his mouth in good condition. The use of a foreign body between the fragments is also a source of irritation under circumstances in which an absolute primary union can scarcely be hoped for. Moreover, the possibility of recurrence is so great that the patient must be watched from month to month, and another operation performed as soon as the tumor shows itself in any part. If a foreign body is present to change the appearance of the wound by its own irritation the early recognition of the new tumor formation is rendered more difficult; and if a second operation proves necessary, the prosthesis must, of course, be removed.

It has been suggested to insert a prosthesis at a late period, but it is difficult to do this satisfactorily even a year after operation; and a much longer time than that must elapse before one can feel sure that there will be no recurrence. Moreover, in many cases there has been so wide a removal of the soft parts, that only a scar remains in which to bury the prosthesis. In other words, the conditions are very different from those which follow the loss of a portion of the horizontal ramus by trauma or inflammation, and in which there has been very little loss of the soft parts.

The decision to reject all foreign bodies in the month after these operations is confirmed by the good functional results which have followed operation in this series of cases, provided the patient has been freed of his malignant disease. Every such patient has good motion of the jaw, and most of them have so developed the lateral motion as to be able to chew on the sound side. One man even goes so far as to claim the operation has cured a long-standing dyspepsia, since now he has to eat more slowly.

Photographs of five of these patients are introduced to show the amount of disfigurement which results from operation and the functional power of the jaw and eyelids.

**LATE RESULTS.** The late results can best be estimated when considered in connection with the character and situation of the growth.

All but one of the fourteen patients operated upon were men.

The ages varied from thirty to seventy-five years, more than half of the patients being between forty-five and fifty-five years old.

As nearly as one could judge the growth started in the jaw (usually in its mucous membrane) in 8 cases; in the lining of the cheek in 3 cases; in the angle of the mouth in 2 cases; while the spindle-cell sarcoma in Case VII seemed to start just below the jaw, possibly from its periosteum.

Nine of the patients had recurrent tumors following operation elsewhere when they first came under my observation. Two presented themselves with primary tumors of the cheek, which I excised

without resection. In both of these cases subsequent removal of the bone failed to arrest the growth. In 3 cases resection was the first operation performed, and in these patients no recurrence has showed itself. It is impossible to state positively that a primary resection would have saved the others, but it would certainly have given them a better chance. If anyone thinks that primary resection is unnecessarily mutilating it is only necessary to point out how rapidly a tumor of the cheek can spread in spite of lesser operations, as seen in Cases X and XII.

Of the eleven resections performed for recurrences, four were known to be merely palliative, but even in these cases the operation seemed well worth while, as the patient was given a clean mouth for varying periods of time. Ten resections were performed with the hope of a permanent cure, 3 being primary operations and 7 after recurrences from other operations. One of these patients died from operation and 2 others from recurrences, while the remaining 7 are at present free from recurrence as far as physical examination can show after periods ranging from six to thirty-three months. It is probably too much to expect that all of these patients are cured, but I think we are justified in saying that the prognosis following partial resection of the lower jaw for cancer is more hopeful than it is generally supposed to be.

A summary of these cases is presented on page 24.

CASE I.—Male, aged seventy-five years. Disease noticed in the right side of the lower jaw for one and a half years. Operation from within the mouth in Richmond, Va. Recurrence soon appeared, but further operating was discouraged.

Operation at New York Skin and Cancer Hospital April 9, 1912. Resection of two and a half inches of the right side of the lower jaw by incisions within the mouth and below the jaw. The anterior cut near the median line showed the remaining bone to be diseased. The posterior cut was through apparently healthy bone. On account of the age and feeble condition of the patient a more extensive operation was considered inadvisable. The wound in the mouth was entirely sutured, as was the skin wound. Primary union resulted with a minute sinus leading to the anterior cut in the bone.

The patient did well for some weeks; then noticing the recurrence, he consulted another surgeon in Richmond, who removed the chin and part of the left ramus. Patient died from shock in forty-eight hours.

Pathological diagnosis by Dr. Jessup: epithelioma, prickle-cell type.

CASE II.—Female, aged forty-five years. Ten months disease existed as a small nodule on the lower jaw opposite the second right bicuspid. After seven months this was removed, with two bicuspid teeth and one molar. In two months recurrence was noticed of a hard, purplish color, with ulceration, at times painful.

Operation at New York Skin and Cancer Hospital July 2, 1912. Right incisors, canine, and second molar teeth were removed. The tumor with surrounding mucous membrane was excised, half or more of the thickness of the jaw bone in its vicinity being chiseled away. The remaining mucous membrane was sutured. The patient recovered promptly.

Two years and nine months later the patient was examined and found free from recurrence.

Pathological diagnosis by Dr. Jessup: epulis, giant-cell sarcoma type. Bone not invaded.

CASE III.—Male, aged forty-four years. Growth began as a blister in the right angle of the mouth. Patient was operated upon in ten days at the Long Branch Hospital, and operated upon a second time one year later. There was again a recurrence, with rapid growth. Fifteen months after the tumor was first noticed it extended from the right angle of the jaw to the median line and from the lip to one inch below the lower margin of the jaw.

Operation at New York Skin and Cancer Hospital August 1, 1912. Most of the patient's lower lip, his chin, and a portion of the lower jaw measuring two and three-quarter inches, mostly on the right side, were removed, together with the submaxillary gland and enlarged lymph glands. The flaps were undermined and an incision to relieve tension was made through the skin of the right cheek. This permitted a complete suture. Gap in the cheek covered with skin grafts. Wound healed primarily, the skin grafts all taking. Patient discharged in eleven days.

Operation at New York Skin and Cancer Hospital September 24, 1912, for a recurrence in the right cheek about three-quarters of an inch in diameter. Wound healed primarily. One month later patient wrote that his face was smooth and all healed. Five months later recurrence began to trouble him and ten and a half months after resection of his jaw, he died.

Pathological diagnosis by Dr. Jessup: epithelioma, prickle-cell type.

CASE IV.—Male, aged fifty-four years. The tumor began in the inner side of the right cheek opposite the second molar. In one year it reached the diameter of about one inch and extended close to the lower jaw.

Operation at New York Skin and Cancer Hospital August 27, 1912. An incision was made across the neck below the jaw and curving upward in front of the ear, also for a short distance down the sternomastoid. The cheek was divided around the tumor. The jaw was cut through back of the bicuspid teeth, twisted out of its articulation, and removed with the tumor and the submaxillary and parotid glands. Branches of the facial nerve to the mouth and eye were divided. Patient was a good deal shocked but recovered sufficiently to leave the hospital in three weeks. Sagging of the

lower eyelid gradually became less marked. Two years and eight months after operation there were no signs of recurrence and patient was in good health (Fig. 4).



Front view, mouth and eyes closed.



Side view, mouth and eyes closed.



Front view, mouth and eyes open.



Side view, mouth and eyes open.

FIG. 4.—Patient No. IV, twenty-nine months after partial resection of the lower jaw, with diarticulation, for epithelioma of cheek. Partial paralysis of the mouth and the right eyelids has gradually lessened until the lips open and close almost normally and the conjunctivitis has disappeared.

Pathological diagnosis by Dr. Jessup: epithelioma of the cheek; no invasion of the lower jaw or lymph nodes.

CASE V.—Male, aged thirty-four years. A tumor began in the left angle of the mouth and in six months reached the size of the end of a thumb, when a V-shaped portion was excised from the lower lip at Red Bank, N. J. Five months later a mass about one inch in diameter was removed from the lower jaw at Asbury Park, N. J. Three months later another small mass was removed by another surgeon. Recurrence persisted until it involved the left horizontal ramus of the jaw and most of the cheek.

Operation at New York Skin and Cancer Hospital October 10, 1912. An incision was made from the left angle of the mouth backward to the angle of the jaw and a second incision carried backward below the horizontal portion of the jaw. The jaw was cut through at the symphysis and behind the angle. A portion of the cheek between these incisions, the part of the lower jaw indicated, and the glands of the submaxillary region and below the angle of the jaw were removed. The wounds in the mucous membrane and the skin were entirely sutured and healed primarily, except at drain points. The patient did well for some months and died of recurrence nine months after operation.

Pathological diagnosis by Dr. Jessup: epithelioma, prickle-cell type.

CASE VI.—Male, aged fifty-two years. Noticed a tender mass under right side of the lower jaw after doing some heavy lifting. Six months later an enlarged "gland" was removed by his physician. Subsequent growth was rapid, with discharge of pus and blood. One month later a mass three inches in diameter involved the right horizontal portion of the lower jaw.

Operation at St. Mary's Hospital, Jamaica, L. I., June 20, 1913. An elliptical incision was made around the tumor and extended down the side of the neck. The lower jaw was cut through one inch from the median line and one inch above the angle. The mucous membrane was cut through close to the jaw, as it was not involved. The involved portion of the lower jaw with the tumor mass, overlying skin, submaxillary and parotid glands, and numerous lymph glands along the sternomastoid were removed. The wound was entirely sutured externally and within the mouth. The patient collapsed from the extensive loss of blood, but recovered and the wound healed satisfactorily.

Recurrences in the neck were noticed in about two months, and death occurred four months after operation.

Pathological diagnosis by Dr. Jessup: epithelioma, prickle-cell type.

CASE VII.—Male, aged sixty-two years. Was operated upon in East Orange, N. J., in April, 1913, for a movable tumor in the left side of the neck close to the jaw, which had been noticed for six months. The tumor was pronounced a spindle-cell sarcoma. The swelling under the jaw never entirely disappeared, and for four

months it seemed to grow more rapidly. Seven months after this operation it measured three inches by two inches and was attached



Front view, mouth and eyes closed.



Side view, mouth and eyes closed.



Front view, mouth and eyes open.



Side view, mouth and eyes open.

FIG. 5.—Patient No. VII, fourteen months after resection of two inches of the lower jaw for recurrent sarcoma attached to but not involving the bone.

to the jaw and to the skin. Small enlarged glands, freely movable, were felt on the right side in the submaxillary region. The inside of the mouth was normal.

Operation at New York Skin and Cancer Hospital November 6, 1913. Two curved incisions were made from the point of the chin to the angle of the jaw, enclosing a piece of skin measuring three inches by two inches. This skin with the tumor and two inches of the jaw bone were removed in one piece. The jaw was cut through just above the angle and just in front of the first molar tooth. The mucous membrane of the mouth was peeled from the jaw so that the mouth was not cut into, the only opening being where the single tooth remaining on the excised portion of the jaw, protruded through the mucous membrane. A part of the parotid gland and one inch of the internal jugular vein were also removed. The wound was entirely sutured with a small drain in the centre of it. The tumor was found to be a spindle-cell sarcoma.

The wound healed primarily excepting for a sinus in the centre, which persisted for two months. Nodules like enlarged glands gradually developed along the left sternomastoid, and a second operation for their removal was performed at New York Skin and Cancer Hospital, June 9, 1914. Through an incision from the left angle of the lower jaw nearly to the clavicle a chain of glands was removed. Some of these involved a part of the sternomastoid muscle, into which the tumor had spread. A portion of the muscle was removed, and the outer part of the sheath of the vessels for a considerable distance was also removed. As the spinal accessory nerve passed through the tumor a portion of it was removed. The glands on the right side of the neck, not having increased in size since the previous operation, were not dissected. Primary union resulted.

Pathological diagnosis by Dr. Jessup: recurrent sarcoma of the neck.

Nine months after this last operation there is no evidence of recurrence. Motions of the lower jaw from side to side, forward and backward, and upward and downward, are almost perfectly performed (Fig. 5).

CASE VIII.—Male, aged fifty years. Following the extraction of a tooth from the left side of the lower jaw there was a persistent soreness of the gum and two months later a rapidly increasing swelling. Four months after the tooth was extracted the swelling was lanced externally. Blood and a little pus escaped and the opening never closed. Five months after the extraction of the tooth there were three openings in the left cheek, discharging pus and blood. The cheek and jaw were much swollen and the top of the gum from the angle of the jaw nearly to the median line was an ulcer with raised, irregular edges.

Operation at New York Skin and Cancer Hospital September 22, 1913. A portion of the left cheek measuring two by three inches, the left half of the lower jaw, excepting the upper part of the ascending ramus, and a mass of submaxillary glands, were removed.



The mucous membrane was entirely sutured and a flap of skin from the neck was swung upward to close the gap in the cheek.

Pathological diagnosis by Dr. Jessup: epithelioma of the jaw and masseter muscle, prickle-cell type.

Three months later the patient returned to the hospital on account of a recurrence just back of the chin and beneath the tongue. One-half inch more of the bone was removed together with a good deal of the floor of the mouth and the deeper tissues. Two weeks after this operation the patient had a sharp attack of dermatitis of the face and neck, probably an erysipelas.



FIG. 6.—Patient No. VIII, sixteen months after resection for two inches of the horizontal ramus and one inch of the ascending ramus for epithelioma of the jaw and cheek. In two subsequent operations the left half of the bony chin and part of the lip, tongue, and floor of the mouth were removed. No apparent recurrence since the last operation, more than a year ago. Motions of the jaw are good, but the size of the mouth is much reduced by removal of one-half of the lower lip and a small part of the upper lip.

Three months after this second operation I again operated for a recurrence in the left side of the chin, extending through the floor of the mouth toward the base of the tongue. This was dissected out very much as one cuts the core from an apple. The tissue removed contained epithelioma.

Thirteen months after the last operation the patient was in good health and apparently free from recurrence, his wounds being entirely healed (Fig. 6).

CASE IX.—Male, aged fifty-four years. Patient noticed a small "pimple" near the right lower wisdom tooth, for which in the succeeding two years he had two local operations and a cauterization. One pathological report was "non-malignant" and the other was

"adamantinoma." The growth recurred in the site of the lower wisdom tooth with slight ulceration and the patient was unable to separate his front teeth more than one half an inch.

Operation at New York Skin and Cancer Hospital October 2, 1913. The tumor with a fair margin of sound tissues including the remains of the tonsil and parts of the pterygoid muscles were removed. The upper part of the jaw bone in the vicinity of the tumor was chiseled away. Dr. Jessup reported the tumor to be of epithelial type, probably malignant. The wound closed rapidly but did not entirely heal and the jaws gradually became more fixed so that they could scarcely be opened at all. A sinus persisted and granulations began to appear in it.

Operation at Miss Alston's Sanitarium April 23, 1914. A vertical incision from a point one inch in front of the ear was extended five inches downward into the neck. Branches of the external carotid artery and numerous veins were ligated. The parotid and sub-maxillary glands were dissected free and the inferior maxilla was cut through one inch in front of the ascending ramus. Its posterior portion was disarticulated and removed. Examination of the specimen showed that the lower jaw was hollowed out near its angle by a new growth which had deeply infiltrated in the region of the pterygoid muscles. The operation was difficult on account of the fixation of the jaw and the patient lost a good deal of blood. He recovered promptly and sat up in a chair for an hour on the third day. On the fourth day before leaving his bed he had an attack marked by pallor, weak pulse and respiration, without immediate loss of consciousness. Stimulants had no effect and patient died in about two hours, apparently from pulmonary embolism.

CASE X.—Male, aged thirty years. A growth developed in the posterior part of the mucous membrane of the right cheek. At the end of three months it was ulcerating and measured about one and a half inches in diameter. The skin, tongue, and jaw bone were apparently not involved.

Operation at New York Skin and Cancer Hospital July 30, 1914. An incision was made from the angle of the mouth backward across the cheek. Skin flaps were dissected upward and downward and mucous membrane was incised one-fourth inch from the tumor, which was then dissected from the lower jaw and pterygoid muscles. The suture of skin was complete and that of the mucous membrane was carried out as far as possible.

Pathological diagnosis by Dr. Barber: epithelioma, prickle-cell type.

The wounds healed primarily but in three weeks there was an evident recurrence on the jaw bone and September 8, 1914, an incision was made from the angle of the mouth downward and outward to the angle of the jaw and then downward along the sterno-

mastoid. A portion of skin overlying the tumor was excised, together with the submaxillary glands, a portion of the parotid, the jaw bone from back of the canine tooth to the middle of the ascending ramus, and a wide area of mucous membrane, all being removed in one piece.

Pathological diagnosis by Dr. Jessup: carcinoma of the lower jaw, involving the glands.

Wound healed primarily except at the drain site, but there was a rapid recurrence within the mouth in the site of the previous operation. The patient was so troubled with a foul discharge and a great deal of pain that six weeks later a large mass of tumor was cut out through the mouth and through the external wound. Relief was only temporary, and three weeks later a wider excision was practised, including the upper portion of the lower jaw and pterygoid muscles, both of which were badly infiltrated with the tumor. The pain and discharge were markedly relieved by the operation but in two weeks the space gained was again filling with tumor tissue, and the patient died six months after the resection.

CASE XI.—Male, aged fifty-four years. A growth in the region of the left tonsil, existing for a year, involved the tonsil, the anterior pillar, a part of the soft palate, and the mucous membrane between the upper and lower jaws and that of the lower jaw as far forward as the second molar, and the adjacent portion of the floor of the mouth and side of the tongue.

Operation at New York Skin and Cancer Hospital July 21, 1914. An incision starting one and a half inches from the chin was extended backward along the lower jaw to the angle and downward along the sternomastoid muscle. Skin flaps were dissected upward and downward. The parotid gland and facial nerve were exposed. The dissection was continued across the cheek below these structures so as to save at least the upper branches of the facial. The jaw was cut through in front of the second molar and through the ascending ramus about one inch above the angle. An incision was made completely around the tumor in the mouth, and the whole mass of excised tissue was removed in one piece after division or the anterior branches of the external carotid and its terminal portions. The wound was partially sutured and drained.

Pathological diagnosis by Dr. Jessup: epithelioma, prickle-cell type. Hyperplasia of nodes.

The patient had to be fed several days through a rubber tube, passed through his nose nearly to the stomach, as he could not swallow. His recovery was rather slow on account of difficulty in taking nourishment. Seven weeks after operation a piece of bone measuring one inch by one-half inch, dead and entirely loose, was pulled out through the mouth from the cut section of the ascending ramus.

Nine months after operation there was still a small sinus, but no evidence of recurrence (Fig. 7).



Front view, mouth and eyes closed.



Side view, mouth and eyes closed.



Front view, mouth and eyes open.



Side view, mouth and eyes open.

FIG. 7.—Patient No. XI, six months after resection of two inches of the horizontal ramus and one inch of the ascending ramus for epithelioma of jaw, tonsil, and adjacent parts. The whole pouch of mucous membrane between the cheek and tonsil, back of the jaws and which allows them to be separated, was excised. The resulting scar limits motion to an extent not seen after the usual resection; but the range of motion has increased since the photograph was taken.

CASE XII.—Male, aged fifty-five years. The patient noticed a rough spot in the left cheek which gradually increased in prominence and later began to ulcerate. One year after it was first observed the growth measured three-quarters of an inch by one-half inch, being freely movable on the upper portion of the cheek, but glands were enlarged below the jaw.

Operation at New York Skin and Cancer Hospital November 13, 1913. A horizontal incision was made below the jaw and a second one from this upward across the cheek. The tumor with deeper tissues of the cheek down to the jaw bone, and a mass of fat and small hard glands from beneath the jaw were removed. The wound was sutured with drainage, and was slow in healing.

Pathologist reported the growth in the cheek to be a prickle-cell epithelioma, while the glands from the neck showed only hyperplasia.

In May, 1914, the patient went to another doctor, who removed a gland from above his clavicle under a local anesthetic.

In August, 1914, there was a recurrence in the posterior part of the alveolar process of the jaw and a hard area in front of the ear and another one above the left clavicle where the gland was removed.

Second operation at New York Skin and Cancer Hospital, August 13, 1914. Incisions from the angle of the mouth were carried backward curving upward and downward so as to include a part of the cheek and neck. The jaw bone was cut through behind the canine tooth and in the middle of the ascending ramus. Several branches of the carotid were ligated. The mucous membrane of the cheek and floor of the mouth were cut through at a good distance from the tumor and the excised portion of the jaw with the tumor and glands attached to it were removed. The mucous membrane was sutured completely and the skin was sutured except for a distance of about an inch in the centre of the wound, where tension would have been too great.

Pathological diagnosis by Dr. Jessup: epithelioma, prickle-cell type.

Recurrence rapidly developed and a palliative operation was performed September 10, 1914. Through a transverse incision beneath the chin a small mass of glands with the surrounding fat, fascia, and muscle were excised. The wound healed primarily, but additional points of growth showed themselves in the region of the tonsil, in the floor of the mouth, in the cheek, and also in the neck in front of the mastoid process.

The patient died five months after the resection.

CASE XIII.—Male, aged fifty-three years. The first symptom was a soreness of the inner side of the right cheek. Five months later a carious tooth and a portion of the right lower jaw were removed from within the mouth. Soon after this the cheek and

jaw began to swell. Three months after this operation the mucous membrane covering the posterior half of the horizontal ramus, and a little of the ascending ramus of the right lower jaw, was the



Front view, mouth and eyes closed.



Side view, mouth and eyes closed.



Front view, mouth and eyes open.



Side view, mouth and eyes open.

FIG. 8.—Patient No. XIII, five months after removal of the right side of the lower jaw from the second bicuspid tooth to the articulation, for epithelioma of the cheek and jaw bone, involving the pterygoid muscles. Paralysis of the mouth and eye has diminished somewhat, and function is constantly improving, but lateral deviation is still marked.

seat of a leukoplakia, in the centre of which there was a papillomatous and ulcerating area. There were enlarged lymph glands in the region of the parotid, and about the bifurcation of the carotid. There was a small leukoplakia on the left lower jaw but no ulceration nor papilloma.

Operation at New York Skin and Cancer Hospital August 15, 1914. The skin was dissected back by an incision starting from the lobe of the ear, following the posterior and lower edges of the lower jaw to about the middle of the horizontal ramus and then curving downward to the centre of the sternomastoid. The neck was freely dissected from the hyoid bone to the ear. The branches of the external carotid and the internal jugular were divided. The parotid gland was removed from behind forward, the muscles of the jaw being cut just below the malar bone and dissected downward before the mouth was opened. The mucous membrane was then cut through wide of the involved area, the jaw sawed behind the second bicuspid, disarticulated, and removed with the attached portions of tumor and other soft tissues. Hemorrhage was profuse, and in spite of clamps and ligation the patient lost considerable blood, and the upper portion of the wound had finally to be packed with gauze. The mucous membrane of the mouth was easily sutured and the skin was sutured excepting for the drain site.

The patient made a good recovery, rapidly overcoming his operative anemia. The wounds where sutured healed primarily with very little leakage from the mouth.

Examination of the specimen showed the bone to be badly penetrated and there was excessive involvement of the pterygoid muscles.

Pathological diagnosis by Dr. Jessup: epithelioma, prickle-cell type. The enlarged lymph glands were hyperplastic only.

Eight months after resection the patient was in good condition. There was no sign of recurrence externally or internally. A minute sinus persisted at the upper end of the external scar in front of the ear, and there was a narrow streak of leukoplakia about one-third of an inch long in the mucous membrane just behind the point where the jaw was sawed through (Fig. 8).

CASE XIV.—Male, aged forty-three years. A dentist called the patient's attention to a growth on the left lower jaw about the site of the bicuspid teeth. Three weeks afterward it was a tumor with a mushroom shape, measuring about three-quarters of an inch in diameter.

Operation at New York Skin and Cancer Hospital October 12, 1914. The growth was removed together with a narrow margin of healthy mucous membrane. The corresponding portion of the alveolar process was chiseled away.

Pathological diagnosis by Dr. Jessup: epulis, giant-cell sarcoma.

Six months later the patient was examined and there was no swelling of the jaw nor any other sign of recurrence.

## SUMMARY OF CASES OF RESECTION OF LOWER JAW.

No.	Sex.	Age.	Physical examination.	Pathological diagnosis	Extent of resection.	Result.
I	M.	75	Jaw, ulcerating; recurrent after operation.	Epithelioma; bone involved.	2½ in. horizontal ramus.	Death in two months after operation elsewhere.
II	F.	45	Jaw, ulcerating; recurrent after operation.	Eplulis; giant-cell sarcoma; bone not involved.	Alveolar process only.	Well; no recurrence for thirty-three months.
III	M.	44	Jaw, ulcerating; recurrent after operation.	Epithelioma; bone involved.	2½ in. from chin backward.	Death in ten and a half months.
IV	M.	54	Mucous membrane of cheek.	Epithelioma; bone not involved.	From bicuspid teeth to joint.	Well; no recurrence for thirty-two months.
V	M.	34	Cheek; recurrent in jaw after three operations.	Epithelioma; bone involved.	From symphysis to above angle.	Death in nine months.
VI	M.	52	Jaw and glands; recurrent after operation in neck.	Epithelioma; bone involved.	From canine tooth to above angle.	Death in four months.
VII	M.	62	Neck below jaw; recurrent after operation.	Spindle-cell sarcoma; bone not involved.	From bicuspid teeth to above angle.	Operation after seven months for recurrence in neck; well; no recurrence for nine months since last operation.
VIII	M.	50	Jaw, ulcerating in mouth and through cheek; recurrent after operation.	Epithelioma; bone involved.	From near symphysis to above angle.	Two other operations for local recurrence in six months; well; no recurrence for thirteen months since last operation.
IX	M.	54	Jaw, ulcerating in mouth; recurrent after operation.	Carcinoma; bone involved.	From bicuspid teeth to joint.	Death in four days from embolism.
X	M.	30	Cheek, ulcerating in mouth; recurrent after operation.	Epithelioma; bone not involved.	From canine tooth to above angle.	Extensive local recurrence in spite of two more operations; death in six months after resection.
XI	M.	54	Cheek; gums; tonsil; tongue; soft palate.	Epithelioma.	From second molar to above angle.	Well; no recurrence for nine months.
XII	M.	55	Cheek and jaw, ulcerating; recurrent after two operations.	Epithelioma	Canine tooth to above angle.	Extensive local recurrence in spite of two more operations; death in five months after resection.
XIII	M.	53	Cheek and jaw, ulcerating in mouth; recurrent after operation.	Epithelioma; bone involved.	From bicuspid teeth to joint.	Well; no recurrence for eight months.
XIV	M.	43	Jaw in mouth.	Eplulis; giant-cell sarcoma.	Alveolar process only.	Well; no recurrence for six months.